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Jawaharlal Nehru

“Step Out From the Old to the New”

IS 11109 (1984) : Silicon brass ingots and castings [MTD 8:  
Copper and Copper Alloys]

**“ज्ञान से एक नये भारत का निर्माण”**

Satyanaaranay Gangaram Pitroda

Invent a New India Using Knowledge



**“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”**

Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”





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*Indian Standard*  
SPECIFICATION FOR  
SILICON BRASS INGOTS AND CASTINGS

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INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## SPECIFICATION FOR SILICON BRASS INGOTS AND CASTINGS

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*Indian Standard*

SPECIFICATION FOR  
SILICON BRASS INGOTS AND CASTINGS

**O. FOREWORD**

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 12 March 1984, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** The material silicon brass have attractive mechanical properties and foundry characteristics. Silicon is partially soluble in the copper matrix but further combined with the second alloying elements to form silicides as precipitate in fine dispersed form which enhances the mechanical properties. In the cast condition, mechanical properties of silicon brass are comparable with those of certain high tensile brasses in  $\alpha + \beta$  range. Silicon brass is more corrosion resistant as the composition covered in this standard is of single phase alloy. Silicon brass finds use in highly stressed thin-walled structural components for engineering and marine application.

**0.3** While preparing this standard, necessary assistance has been derived from ASTM B 584-79 'Specification for copper alloy sand casting for general appliances', issued by the American Society for Testing and Materials.

**0.4** In preparing this standard, the Sectional Committee kept in view the manufacturing and trade practices followed in the country in this field.

**0.5** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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\*Rules for rounding off numerical values (*revised*).

## 1. SCOPE

**1.1** This standard covers the requirements for two grades of silicon brass ingots and sand castings.

## 2. SUPPLY OF MATERIAL

**2.1** General requirements relating to the supply of material are laid down in IS : 1387-1967\*.

## 3. CHEMICAL COMPOSITION

**3.1** The material shall have the chemical composition as given in Table 1.

**TABLE 1 CHEMICAL COMPOSITION**

CONSTITUENT	PERCENT					
	Grade 1		Grade 2		Grade 3	
	Ingots	Castings	Ingots	Castings	Ingots	Castings
Copper	79.0 Min	79.0 Min	88.0 Min	88.0 Min	80-83	80-83
Silicon	3.2-5.0	3.0-5.0	3.7-5.5	3.5-5.5	4.1-4.7	3.9-4.7
Zinc	12.5-16.0	12.0-16.0	4.5-7.0	4.0-7.0	Remainder	Remainder
Lead, Max	0.50	0.50	0.50	0.50	0.40	0.40
Aluminium, Max	0.50	0.50	—	—	0.05	0.05
Iron, Max	0.30	0.30	0.30	0.30	0.30	0.30
Total other impurities, Max	0.50	0.50	0.50	0.50	0.50	0.50

**3.2** The chemical composition shall be determined either by the method specified in IS : 3685-1966† or any other established instrumental/chemical method. In case of dispute, the procedure specified in the latest version of IS : 3685 for chemical analysis shall be the referee method.

## 4. MECHANICAL PROPERTIES

**4.1** The material, when tested in accordance with IS : 2654-1977‡ shall have the tensile properties as given in Table 2.

\*General requirements for the supply of metallurgical materials (*first revision*).

†Methods of chemical analysis of brasses.

‡Method for tensile testing of copper and copper alloys (*first revision*).

**TABLE 2 TENSILE PROPERTIES**  
( Clause 4.1 )

MODE OF CASTING TEST PIECES	PROPERTY	REQUIREMENT		
		Grade 1	Grade 2	Grade 3
Sand cast ( separately cast )	Tensile strength, <i>Min.</i> , MPa	414	414	390
	*0·2 percent proof stress, <i>Min.</i> , MPa	165	207	175
	Elongation on gauge length of $4\sqrt{A}$ , per- cent, <i>Min.</i>	16	16	25

NOTE — 1 MPa = 1N/mm<sup>2</sup> = 0·102 kgf/mm<sup>2</sup>.

\*For information only.

**4.2 Pressure Test** — If the purchaser requires castings to be tested for pressure tightness, this shall be stated in the enquiry and order. The number of tests, the nature of the test, the test pressure and the testing fluid shall be as specified.

## 5. FREEDOM FROM DEFECTS

**5.1 Ingots** — The ingots shall be of uniform quality and reasonably free from slag, dross and other harmful contaminations.

**5.2 Castings** — The castings shall be clean and free from harmful defects, such as blow holes, gas cavities, etc. Castings shall not be repaired unless permission in writing has been obtained previously from the purchaser or his representative.

## 6. SHAPE AND SIZE

**6.1** Shape and size of ingots shall be as agreed to between the manufacturer and the purchaser.

**6.2** The dimensions and shape of the castings shall be in accordance with the drawings. All surfaces marked for machining shall have sufficient allowance for that purpose but shall not be too excessive resulting in more machining and unnecessary increase in the mass of the casting.

## 7. MARKING

**7.1** The name, or trade-mark of the manufacturer and the cast number and grade of the material shall be cast or otherwise legibly marked by stamping on each casting by which the manufacturer and the grade of the material may be identified. In the case of small castings where it is difficult to cast on or stamp all the details, the marking shall be as agreed to between the supplier and the purchaser.

**7.1.1** The material may also be marked with the ISI Certification Mark.

**NOTE** — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## 8. SAMPLING AND CRITERIA FOR CONFORMITY

**8.0** Unless otherwise decided by mutual agreement of the purchaser and the supplier, the following sampling procedure and criteria for conformity shall hold good.

**8.1 Lot** — In any consignment, ingots/castings of the same grade (*see* Table 1) manufactured at the same place under similar condition shall be grouped together to constitute a lot.

**8.2 Sampling for Chemical Analysis** — One sample shall be taken and analysed from each cast of 1 000 kg or part thereof of the ingots and castings. However, in case more frequent chemical analysis is required, the same shall be agreed to between the supplier and the purchaser. The sampling for chemical analysis shall be taken by drilling or sawing in such a manner as to be representative of the entire cross-section. Drillings and sawings from ingots or castings shall be obtained in accordance with the appropriate procedure specified in IS : 1817-1971\*.

**8.2.1** If the test results of chemical analysis as obtained for each of the constituents satisfy the corresponding requirements, the lot shall be considered as conforming to the chemical requirement of the specification.

**8.3 Sampling for Mechanical Properties** — Three test bars shall be separately cast along with the ingots or castings for tensile strength for every 1 000 kg or part thereof of the ingots or castings. These test bars shall be cast to shape in accordance with **4.3.1** and Appendix B of IS : 1408-1968†. These test bars shall be of suitable size for turning

\*Methods of sampling non-ferrous metals for chemical analysis.

†Recommended procedure for inspection of copper base alloy sand castings.  
(first revision).

them to the standard dimensions of the test piece as laid down in IS : 2654-1977\*.

**8.3.1** Out of three test bars, one bar shall be tested for mechanical test for every 1 000 kg or part thereof of ingots/castings. If the test results satisfy the requirements of mechanical properties, the lot shall be considered as conforming to the mechanical properties.

#### **8.4 Retests**

**8.4.1** If the sample drawn for chemical analysis fails to meet the requirements stipulated in the standard, two more tests shall be conducted on the same sample in order to confirm that the analysis has been done properly. If both the test results satisfy the relevant requirements, the lot shall be accepted; if either of the retest fails, the lot represented shall be deemed as not complying with the standard.

**8.4.2** Should a test bar fails to meet the requirements of the tensile properties specified in the standard, two further test bars which represent the same cast may be tested in the same manner. Should one of the further test bars meet the requirements of the tensile properties, the ingots or castings represented thereby shall be deemed to comply with the standard, otherwise the lot shall be rejected.

### **9. INFORMATION TO BE GIVEN BY THE PURCHASER**

**9.1** This standard contains a number of clauses in which the purchaser is allowed to exercise an option. The list of information to be given by the purchaser in respect to these clauses is given in Appendix A.

### **A P P E N D I X A**

( *Clause 9.1* )

**A-1.** Whether the purchaser wishes to inspect the material at the supplier's works ( *see 2* and IS : 1387-1967† ).

**A-2.** The alloy grade required ( *see 3.1* ).

**A-3.** Detailed drawings of castings ( *see 6.1* ).

**A-4.** Preparation of test piece for tensile testing ( *see 8.3* ).

**A-5.** Whether a pressure test is required ( *see 4.2* ). Details are subject to agreement with the supplier.

**A-6.** Marking details ( *see 7* ).

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\*Method for tensile testing of copper and copper alloys (*first revision*).

†General requirements for the supply of metallurgical materials (*first revision*).

# INTERNATIONAL SYSTEM OF UNITS ( SI UNITS )

## Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>